

REVISION OF THE NEARCTIC SPECIES OF THE
TRISSOLCUS FLAVIPES GROUP
(HYMENOPTERA: SCELIONIDAE)

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Abstract.—Four species of the *Trissolcus flavipes* group are recognized in the Nearctic: *T. brochymenae* (Ashmead) [southern USA, Mexico], *T. edessae* Fouts [southeastern USA west to Kansas, Texas], *T. euschisti* (Ashmead) [widespread] and *T. strabus* new species [widespread]. The names *Trissolcus murgantiae* Ashmead and *Trissolcus rufiscapus* Ashmead are synonymized with *T. brochymenae*; *Trissolcus podisi* Ashmead and *Trissolcus rufitarsis* Kieffer are synonymized with *T. euschisti*. Lectotypes are designated for *T. euschisti* and *T. rufitarsis*. An identification key is provided; known host and distribution data are summarized.

The genus *Trissolcus* Ashmead (= *Asolcus* Nakagawa, *Microphanurus* Kieffer) is one of the two main groups within the subfamily Telenominae (Hymenoptera: Scelionidae). All species of the genus are egg parasitoids of bugs of the superfamily Pentatomoidea (Heteroptera). Many of these hosts are economically important pests, and, as a result, there has been interest in species of *Trissolcus* as biological control agents.

Species of *Trissolcus* may be recognized using the keys of Masner (1976, 1980). Most of the abbreviations and morphological terms used in this revision are defined in Masner (1980). The *hyperoccipital carina* (*hc*, Fig. 5), a term introduced by Masner (1979), refers to a carina that, in the Telenominae, runs continuously across the vertex from one eye to the other, behind the lateral ocelli, and merging with the outer orbit of the eye without joining the occipital carina. The inner orbit of most species of the group discussed in this paper is bounded by a distinct furrow that expands in width ventrally; this is referred to as the *orbital furrow* (*of*, Fig. 3). Above the base of the mandibles in many species of *Trissolcus* is a large, sometimes poorly-defined puncture, into which one or a few setae are inserted; this is the *pleurostomal puncture* (*p*, Fig. 2). *Sublateral setae* refer to one or more pairs of posteriorly directed setae near the sides of the first metasomal tergite, not the laterally directed setae near the laterotergite line of flexion.

The descriptions represent summaries only of character states distinguishing the hypothesized species and refer to both sexes unless specifically indicated otherwise. As such they are based on the series of specimens, not a single specimen. Because of the inadequacy of Ashmead's 1893 key for identification I have not cited host data published in the literature. The sections summarizing host information refer only to specimens that I have seen.

This revision is based upon material from the following institutions and persons (with acronyms used in the text in parentheses): California State Department of Food and Agriculture, Sacramento, CA; Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, ONT (CNC); Cornell University Insect Collection, Ithaca, NY; Florida State Collection of Arthropods, Gainesville, FL (FSCA); Kansas State University, Manhattan, KS; Los Angeles County Museum, Los Angeles, CA; Mississippi Entomological Museum, Mississippi State, MS; Museum of Comparative Zoology, Harvard University, Cambridge, MA (MCZ); The Ohio State University, Columbus, OH; Texas A&M University, College Station, TX; U.S. National Museum of Natural History, Washington, DC (USNM); University of California, Riverside, CA; and the collections of D. C. Darling (Ithaca, NY) and the author (NFJ).

The *flavipes* group of *Trissolcus* was first recognized by Kozlov and Lê (1976). They characterized the group as those species with notauli, a strongly convex frons, and a hyperoccipital carina. The diagnosis of the *flavipes* group can be expanded as follows: hyperoccipital carina present (*hc*, Fig. 5, Figs. 6–8), rarely interrupted medially (Fig. 4); frons with large setigerous punctures at least laterally (Figs. 3, 5, 7); frons strongly bulging between antennal insertions and inner orbits; orbital furrow usually strongly expanded ventrally (*of*, Fig. 3; Figs. 1, 5); radicle of antenna light in color, concolorous with or lighter than scape, never darker; genal surface rounded from malar sulcus to occipital carina, with no carina extending from base of mandibles dorsad; notauli well-developed (*n*, Fig. 11; Fig. 9); central longitudinal keel between notauli usually present; sublateral setae on T1 usually absent (Figs. 16–20).

The *Trissolcus flavipes* group is worldwide in distribution. It is, however, most diverse in the New World, and, in particular, in the Neotropics. This paper deals only with the Nearctic representatives of the group. Four species are recognized: *T. brochymenae* (Ashmead), *T. edessae* Fouts, *T. euschisti* (Ashmead), and *T. strabus* new species. *Trissolcus brochymenae* is a southern species whose range extends well into the Neotropics; it can be found as far north as Missouri, Kansas and New Jersey. It is sympatric throughout its Nearctic range with *T. euschisti*, but only the latter species can be found in the northern states and Canada. *Trissolcus edessae* is a southeastern U.S. species and may also be found in the West Indies; *T. strabus* is widespread in the Nearctic, but is rare.

The expression of many characters of the species of this group appears to be strongly affected by the size of the individual. Masner reported this phenomenon in *Trissolcus* in 1959. He noted that the development of frontal sculpture, mesoscutal sculpture, the central keel on the mesoscutum, and the length of antennomeres may be highly variable. In addition to these characters, I have found that the number of setae on the lateral margins of T1, above the mid coxae, and on S1, and the extent of the sculpture on T2 are variable and appear to be related to size. This is especially a problem in *T. euschisti*, here interpreted as a polyphagous and geographically widespread species.

KEY TO NEARCTIC SPECIES OF THE *TRISSOLCUS FLAVIPES* GROUP

1. Orbital furrow narrow ventrally (Figs. 7, 8); scutellum rugulose (Figs. 11, 12) *strabus*
- Orbital furrow strongly expanded ventrally (Figs. 1, 3, 5); scutellum

with shallowly impressed coriaceous sculpture (Fig. 10) or smooth (Fig. 9) 2

2(1'). Mesopleural carina absent (Fig. 15); female antennal flagellum abruptly bicolored: A1–A6 yellow, A7–A11 dark brown *edessae*

– Mesopleural carina present (*mc*, Fig. 13; Figs. 1, 14); female antennal flagellum infusate throughout 3

3(2'). Ventral portion of mesepisternum anterior to mesopleural carina rugulose (Fig. 13) *brochymenae*

– Ventral portion of mesepisternum anterior to mesopleural carina smooth or with shallowly impressed coriaceous microsculpture (Fig. 14) *euschisti*

SPECIES DESCRIPTIONS

Trissolcus brochymenae

Figs. 1, 2, 13, 16

Telenomus Crochymenae Ashmead, 1881: 193. Type locality: Jacksonville, Florida. Host: *Brochymena arborea* (Pentatomidae). Lectotype No. 2855 (examined) in USNM.

Trissolcus brochymenae: Ashmead, 1893: 164.

Trissolcus murgantiae Ashmead, 1893: 163. Type locality: Baton Rouge, Louisiana. Host: *Murgantia histrionica* (Pentatomidae). **New synonymy.** Lectotype No. 2231 (examined) in USNM.

Trissolcus rufiscapus Ashmead, 1893: 163. Type locality: Washington, D.C. Host unknown. **New synonymy.** Holotype No. 2232 (examined) in USNM.

Trissolcus murgantiae: Kieffer, 1926: 128.

Trissolcus brochymenae: Kieffer, 1926: 129.

Trissolcus rufiscapus: Kieffer, 1926: 129.

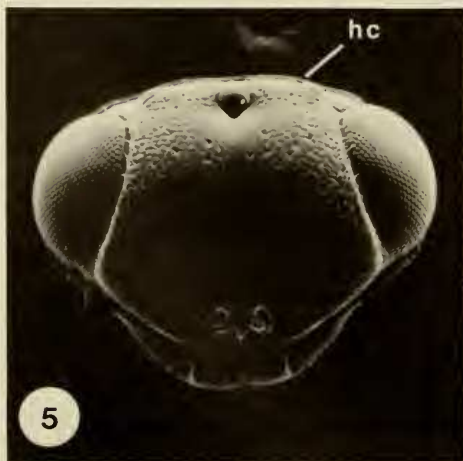
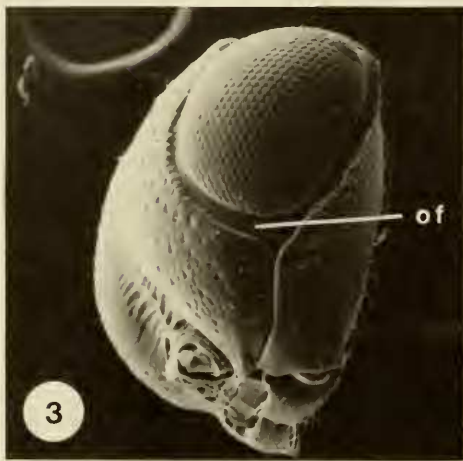
Trissolcus brochymenae: Masner and Muesebeck, 1968: 72 (lectotype designation).

Trissolcus murgantiae: Masner and Muesebeck, 1968: 73 (lectotype designation).

Length: 1.1–1.3 mm; orbital furrow expanded ventrally (Fig. 1); hyperoccipital carina present, sometimes low medially, but head at least sharply angled at vertex; female antennal flagellum not abruptly bicolored, A3–A11 dark brown to black; genae above mandibles smooth, pleurostomal puncture present (*p*, Fig. 2); mesoscutum with coriaceous microsculpture throughout, irregularly longitudinally rugulose anteriorly; scutellum with effaced coriaceous microsculpture, sometimes smooth; dorsellum excavate ventrally; ventral portion of mesepisternum anterior to mesopleural carina strongly rugulose (Figs. 1, 13); femora and tibiae usually yellow, sometimes (especially in arid regions and in Neotropics) infusate; mesopleural carina present (*mc*, Fig. 13); metasoma (Fig. 16): no sublateral setae on T1; T2 smooth beyond basal costae; T2 with short transverse subapical setal band, few setae along T2-laterotergite line of flexion.

Hosts: *Acrosternum hilare*, *Murgantia histrionica*, *Nezara viridula* (Heteroptera: Pentatomidae).

Distribution: *Arkansas* (Phillips, Pike Co.), *California* (Humboldt Co., Orange Co., San Diego Co., Santa Clara Co.), *Florida* (Alachua Co., Baker Co., Duval Co., Pinellas Co.), *Georgia* (Cobb Co.), *Kansas* (Cherokee Co.), *Louisiana* (E. Baton Rouge Parish), *Maryland* (Anne Arundel Co., Montgomery Co., Prince



Figs. 1–2. *Trissolcus brochymenae*. 1, Head and mesosoma, lateral view; 2, Detail of lower part of head, lateral view; *p*: pleurostomal puncture. Figs. 3–4. *T. edessae*. 3, Head, fronto-lateral view; *of*: orbital furrow. 4, Head and mesosoma, dorsal view. Figs. 5–6. *T. euschisti*, head. 5, Frontal view; *hc*: hyperoccipital carina. 6, Fronto-lateral view.

Georges Co.), *Mississippi* (Oktibbeha Co., Pontotoc Co.), *Missouri* (Boone Co., Wayne Co.), *New Jersey* (Burlington Co.), *North Carolina* (Wake Co.), *South Carolina* (Florence Co., Richland Co.), *Tennessee* (Anderson Co., Blount Co.), *Texas* (McLennan Co.), *Virginia* (Shenandoah Co.). Mexico: *Baja California Sur*, *Nuevo Leon*, *Sonora*.

Remarks.—*Trissolcus brochymenae* is most similar to *T. euschisti* and may be distinguished from it by the strongly rugulose ventral portion of the mesepisternum anterior to the mesopleural carina (Fig. 13). This species is also similar to *T. euschisti* in that it shows a great deal of variability, presumably in association with its wide geographic distribution and host range.

Trissolcus edessae

Figs. 3, 4, 15, 17

Trissolcus edessae Fouts, 1920: 65. Type locality: New Orleans, Louisiana. Host: *Edessa bifida* (Pentatomidae). Holotype No. 22797 (examined) in USNM.

Orbital furrow expanded ventrally (Fig. 3); hyperoccipital carina effaced medially, vertex there rounded (Fig. 4); female antennal flagellum abruptly bicolored, A1–A6 yellow, A7–A11 dark brown; genae above mandibles coriaceous except for narrow strip at base of mandibles (Fig. 3), pleurostomal puncture present; disc of mesoscutum coriaceous; scutellum with coriaceous microsculpture anteriorly, otherwise smooth; dorsellum excavate ventrally; anteroventral portion of mesepisternum coriaceous, with few irregular rugae (Fig. 15); legs beyond coxae yellow; mesopleural carina indicated only by short raised keel ventrally (Fig. 15); metasoma (Fig. 17): no sublateral setae on T1; T2 smooth beyond basal costae; T2 with short, subapical band of setae, 3–4 setae along T2-laterotergite line of flexion.

Host: Acrosternum hilare, Edessa bifida (Heteroptera: Pentatomidae).

Distribution: Florida (Dade Co., Stock Is.); *Georgia* (Cobb Co.); *Kansas* (Cherokee Co.); *Louisiana* (E. Baton Rouge, Orleans Parish); *Mississippi* (Panola Co.); *South Carolina* (Darlington Co.); *Texas* (Galveston Co.).

Remarks.—*Trissolcus edessae* may be easily recognized among the species of the *flavipes* group dealt with here by the abruptly bicolored female antennae and the lack of a well-developed mesopleural carina.

Trissolcus euschisti

Figs. 5, 6, 9, 10, 14, 18, 19

Telenomus euschristus Ashmead, 1888: ii. Type locality: Manhattan, Kansas.

Host: "Pentatomid eggs, which apparently belong to some species of *Euschristus* or an allied form." (Pentatomidae). Lectotype (designated below) in collection of Kansas State University.

Trissolcus euschisti: Ashmead, 1893: 162.

Trissolcus podisi, Ashmead, 1893: 162. Type locality: Philadelphia, Pennsylvania.

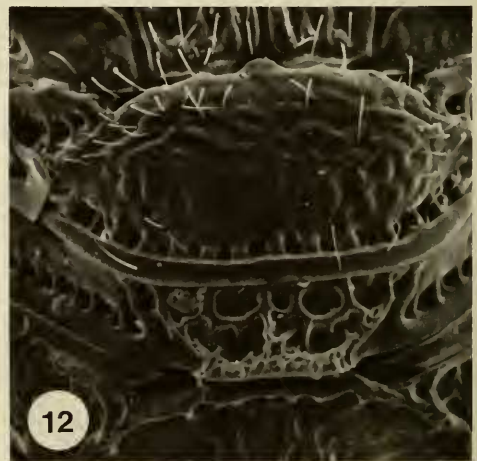
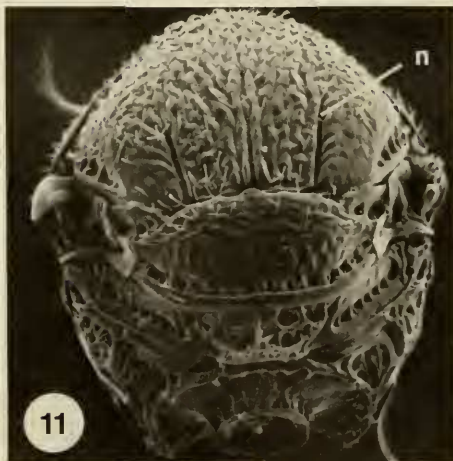
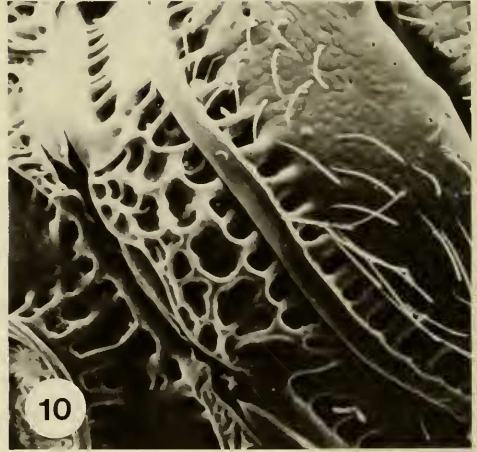
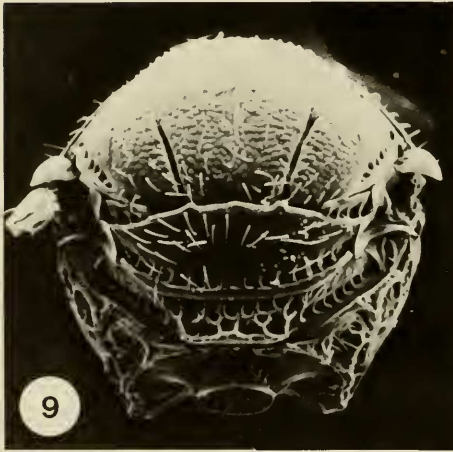
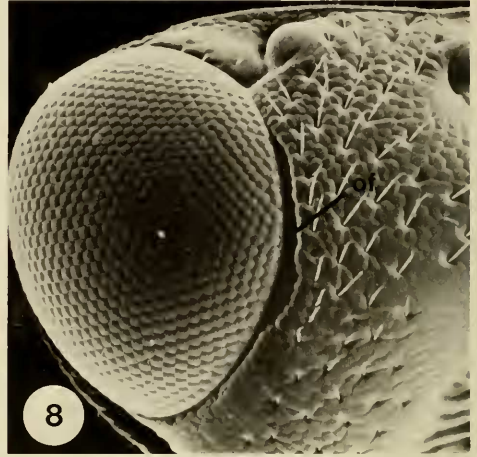
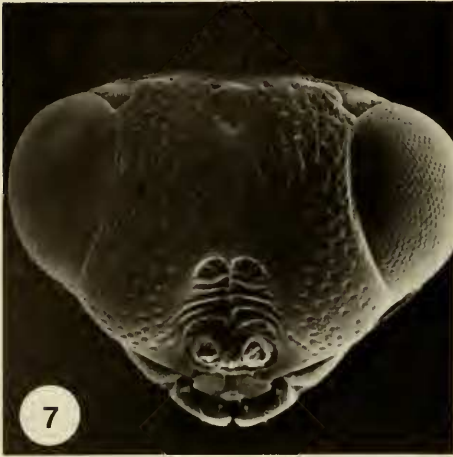
Host: *Podisus spinosus* (Pentatomidae). **New synonymy.** Lectotype No. 2229 (examined) in USNM.

Trissolcus rufitarsis Kieffer, 1905: 262. Type locality: Ormsby, Nevada. **New synonymy.** Lectotype (designated below) in Cornell University Insect Collection.

Trissolcus euschisti: Kieffer, 1926: 129.

Trissolcus podisi: Kieffer, 1926: 129.

Trissolcus podisi: Masner and Muesebeck, 1968: 73 (lectotype designation).



Figs. 7-8. *Trissolcus strabus*, head. 7, Frontal view. 8, Detail of orbital furrow; *of*: frontal view. Figs. 9-10. *T. euschisti*. 9, Mesosoma, dorsal view. 10, Scutellum and dorsellum, postero-dorsal view. Figs. 11-12. *T. strabus*. 11, Mesosoma, dorsal view; *n*: notaulus. 12, Scutellum and dorsellum, postero-dorsal view.

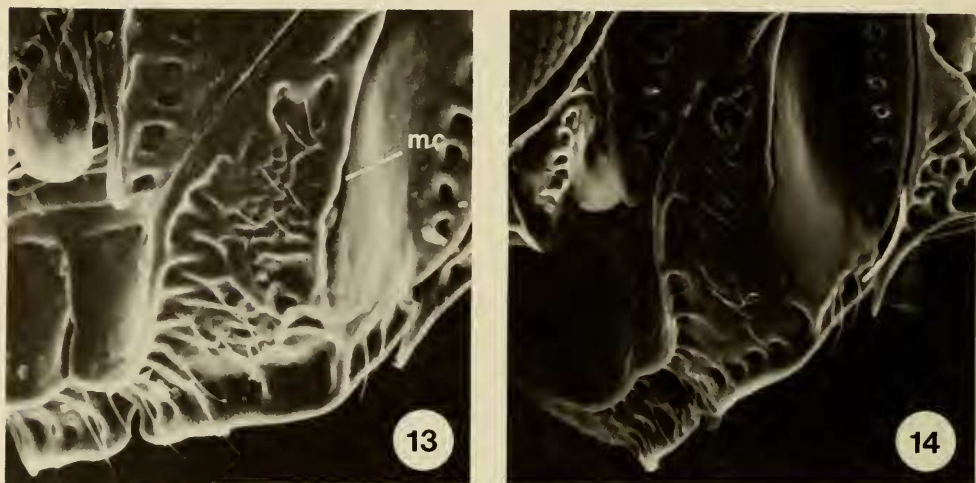
Orbital furrow distinctly expanded ventrally (Figs. 5, 6); hyperoccipital carina present (Figs. 5, 6, *hc*); female antennal flagellum darkened throughout, not abruptly bicolored; genae above mandibles smooth, pleurostomal puncture present (Fig. 5); mesoscutum with coriaceous microsculpture throughout (Fig. 9), rugulose anteriorly; scutellum with coriaceous microsculpture (Fig. 10), smooth in small specimens; dorsellum excavate ventrally; ventral portion of mesepisternum anterior to mesopleural carina smooth or with shallowly impressed coriaceous microsculpture (Fig. 14); femora and tibiae infuscate medially; mesopleural carina usually present, sometimes poorly developed anteriorly (especially in large specimens, Fig. 14); metasoma (Figs. 18, 19): no sublateral setae on T1; large specimens with longitudinal wrinkles on T2 beyond basal costae (Fig. 19), smaller forms with T2 smooth beyond costae (Fig. 18); T2 setation limited to short transverse subapical band, few setae along T2-laterotergite line of flexion.

Hosts: Acanthosomatidae sp., probably *Elasmotherus cruciatus*; *Acrosternum hilare*; *Banasa dimidiata*; *Brochymena quadripustulata*; *Brochymena sulcata*; *Brochymena* sp.; *Cornifrons ebotalis*; *Euschistus* sp.; *Murgantia histrionica*; *Perillus ocularis*; *Perillus* sp.; *Podisus maculiventris*; *Podisus sereiventris*; *Podisus* sp.; *Tetyra bipunctata*.

Material examined.—*Telenomus euschisti* lectotype female (*here designated*). Label data: “Riley Co Ks, Marlatt; 763; Lectotype female *Telenomus euschisti* Ashmead, desig. N. Johnson.” The egg mass is also pinned. The lectotype is deposited in the collection of the Kansas State University. Ashmead (1888) specified that the description was based upon two specimens labelled 763. Later (1893) he stated that the types were located both in Kansas State and in his collection, which is now in the USNM. The lectotype is the only specimen I have found with the 763 label. At least two other specimens have only a “Riley Co, Ks, Marlatt” label. Since I cannot determine which one Ashmead may have used in the original description, I have not designated a paralectotype.

Trisolcus rufitarsis lectotype female (*here designated*). Label data: “Ormsby Co. Nev, July. Baker; 105; Paratype Cornell U. No. 388.1; *Trisolcus* [sic] *rufitarsis* K, Paratype.” Lectotype deposited in Cornell University. Masner (1976) reported that the types of Kieffer’s species from the Baker collection were transferred from Pomono College to the California Academy of Sciences (San Francisco), and that some syntype material was obtained by Cornell University through exchange. Dr. Wojciech Pulawski (CAS) has, however, informed me (in litt.) that the type of *T. rufitarsis* is not in that collection. Accordingly, I have designated the Cornell specimen as the lectotype.

Many other specimens were examined from the following areas: *Arizona* (Cochise Co., Coconino Co.); *Arkansas* (Garland Co.); *California* (Alameda Co., Merced Co., Sacramento Co., San Diego Co., Santa Clara Co., Shasta Co., Yolo Co.); *Connecticut* (Fairfield Co.); *Florida* (Alachua Co., Baker Co.); *Georgia* (Peach Co.); *Idaho* (Owyhee Co.); *Indiana* (Greene Co., Martin Co.); *Iowa* (Woodbury Co.); *Kansas* (Riley Co.), *Louisiana* (Beauregard Parish); *Maryland* (Baltimore Co., Montgomery Co.); *Massachusetts* (Middlesex Co.); *Michigan* (Oscoda Co.); *Mississippi* (Oktibbeha Co.); *Missouri* (Wayne Co.); *New Mexico* (Dona Ana Co., Valencia Co.); *New York* (Dutchess Co., Greene Co., Tompkins Co.); *North Carolina* (Buncombe Co., Macon Co., Wake Co.); *North Dakota* (Burleigh Co.); *Ohio* (Hocking Co., Tuscarawas Co., Wayne Co.); *Oklahoma* (McIntosh Co.); *Pennsylvania* (Franklin Co.); *South Carolina* (Anderson Co., Barnwell Co.); *South*



Figs. 13–14. Ventral portion of mesepisternum, antero-lateral view, legs removed. 13, *Trissolcus brochymenae*, mc: mesopleural carina. 14, *T. euschisti*.

Dakota (Pennington Co.); Tennessee (Henderson Co., Shelby Co.); Texas (Brewster Co., Brown Co., McLennan Co., Uvalde Co.); Utah (Cache Co., Davis Co.); Virginia (Fairfax Co., Frederick Co.); West Virginia (Kanawha Co.); District of Columbia. Canada: British Columbia; Ontario; Quebec. Mexico: Jalisco, Morelos, Vera Cruz.

Remarks.—*Trissolcus euschisti* may be distinguished from the similar *T. brochymenae* by the smooth or shallowly impressed sculpture on the ventral portion of the mesepisternum anterior to the mesopleural carina (Fig. 14). The smaller specimens of what I take to be *T. euschisti* are often quite distinct from the larger ones in the following characters: number of lateral setae on T1, extent of fine wrinkles on T2, extent of wrinkles on S2, extent of S1 setation, number of setae on the mesopleuron above the mid coxae, sculpture of the upper portion of the frons, extent of transverse striae within the antennal scrobes, and the presence of a shallow groove below the median ocellus. Ashmead's species *Trissolcus podisi* represents the small form, *T. euschisti* the large. The two extremes in size may be rather easily separated on the basis of these characters, but intermediate forms also exist, although they are much less common. The larger form seems to be more common in the south and the smaller one in the north, but both extremes and intermediates may be found throughout the range cited above. I therefore hypothesize that they belong to the same, geographically widespread and polyphagous species. It is upon this basis that I have synonymized the names *T. podisi* and *T. rufitarsis*.

Yeargan (1982) discussed some aspects of the reproductive biology of *Trissolcus euschisti*. He noted that the fecundity of a single female was generally sufficient to parasitize all of the eggs within a mass of such hosts as *Podisus maculiventris* and *Euschistus servus*. He indicated, however, that both *T. euschisti* and *Telenomus podisi* were capable of successfully parasitizing bug eggs up to the seventh day of host embryonic development (with eclosion of nymphs occurring on day 8 or 9). This extended period of parasitization capability is unusual in the Telen-

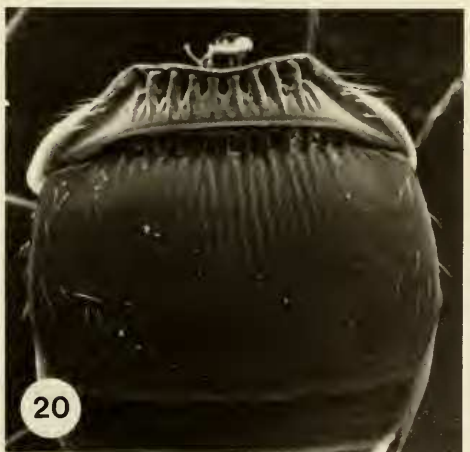
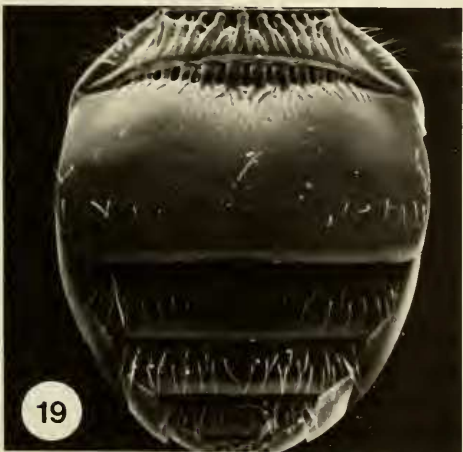
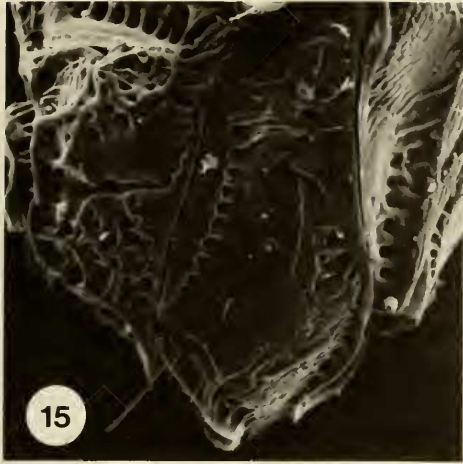


Fig. 15. *Trissolcus edessae*, mesosoma, lateral view. Figs. 16–20. Metasoma, dorsal view. 16, *T. brochymenae*. 17, *T. edessae*. 18, *T. euschisti*, small form. 19, *T. euschisti*, large form. 20, *T. strabus*.

ominae in general, but is consistent with Hidaka's (1958) observations of another pentatomid egg parasite, *Telenomus gifuensis* (see Johnson, 1984).

Trissolcus strabus, NEW SPECIES

Figs. 7, 8, 11, 12, 20

Orbital furrow strongly narrowed ventrally (Figs. 7, 8); hyperoccipital carina present (Figs. 7, 8); female antennal flagellum infuscate throughout; genae above mandibles smooth, pleurostomal puncture present; mesoscutum with coriaceous background microsculpture, rugulose throughout (Fig. 11); scutellum with same sculpture as mesoscutum, microsculpture often effaced (Fig. 12); dorsellum excavate ventrally; ventral portion of mesepisternum smooth; femora and tibiae infuscate; mesopleural carina present; metasoma (Fig. 29): no sublateral setae on T1; T2 with rugulae extending beyond costae over basal two-thirds of sclerite; T2 with short subapical band of setae, few setae along T2-laterotergite line of flexion.

Host unknown.

Material: Holotype female; *Ontario*, Hamilton, 31.vii.1981, M. Sanborne, Malaise trap (CNC). Paratypes. Two females with same locality data as holotype, one collected 31.vii.1981, one on 9–13.vii.1981 (CNC). *California*: Sta Cruz Mts., 2 females (USNM). *Florida*: Alachua Co., Gainesville, Pine Hill Estates; 27.ix.1973, H. V. Weems, Jr., Malaise trap, 1 female (FSCA). *New Jersey*: Burlington Co., Atsion, 23.vii.1980, J. E. Rawlins, 1 female (NFJ). *Tennessee*: Lexington, Natchez Trace S.P., 11–15.vi.1972, Mal. tr., G. Heinrich, 3 females (CNC). *Texas*: Brownsville, 11–16.vi.1933, Darlington, 1 female (MCZ); *Utah*: Farmington, 25.v.1936; ex eggs on peach bark; Lot No. 36-35291, 9 females, 2 males (USNM).

Remarks.—*Trissolcus strabus* is distinctive among all species of the *flavipes* group discussed here (*brochymenae*, *edessae*, *euschisti*) by the ventral constriction of the orbital furrow. In addition, among the Nearctic species it is also characterized by the relatively coarsely sculptured mesoscutum and scutellum. This species is widely distributed throughout the Nearctic region, but appears to be relatively uncommon.

The name *strabus*, from the Latin for squinting, refers to the constricted orbital furrow.

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